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ABSTRACT

This student booklet is one of a set of eight designed to be used in a self-paced introductory chemistry course in conjunction with specified textbooks and computer-assisted instruction (CAI) modules. Each topic is introduced with a textbook reading assignment and additional readings are provided in the booklet. Also included are self-tests (and answers), CAI module assignments, and suggested breakpoints for student-teacher consultations. Supplementary learning materials, including filmstrips, are also suggested. Each booklet contains specific cognitive objectives to be met by completion. This booklet covers five areas of terminology: matter, properties, and change; classification of matter; symbols; energy; and the nature of science. (MH)

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ILS CHEM PAC No. 2

TERMINOLOGY

by

William Torop

West Chester State College
West Chester, Pennsylvania

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1976

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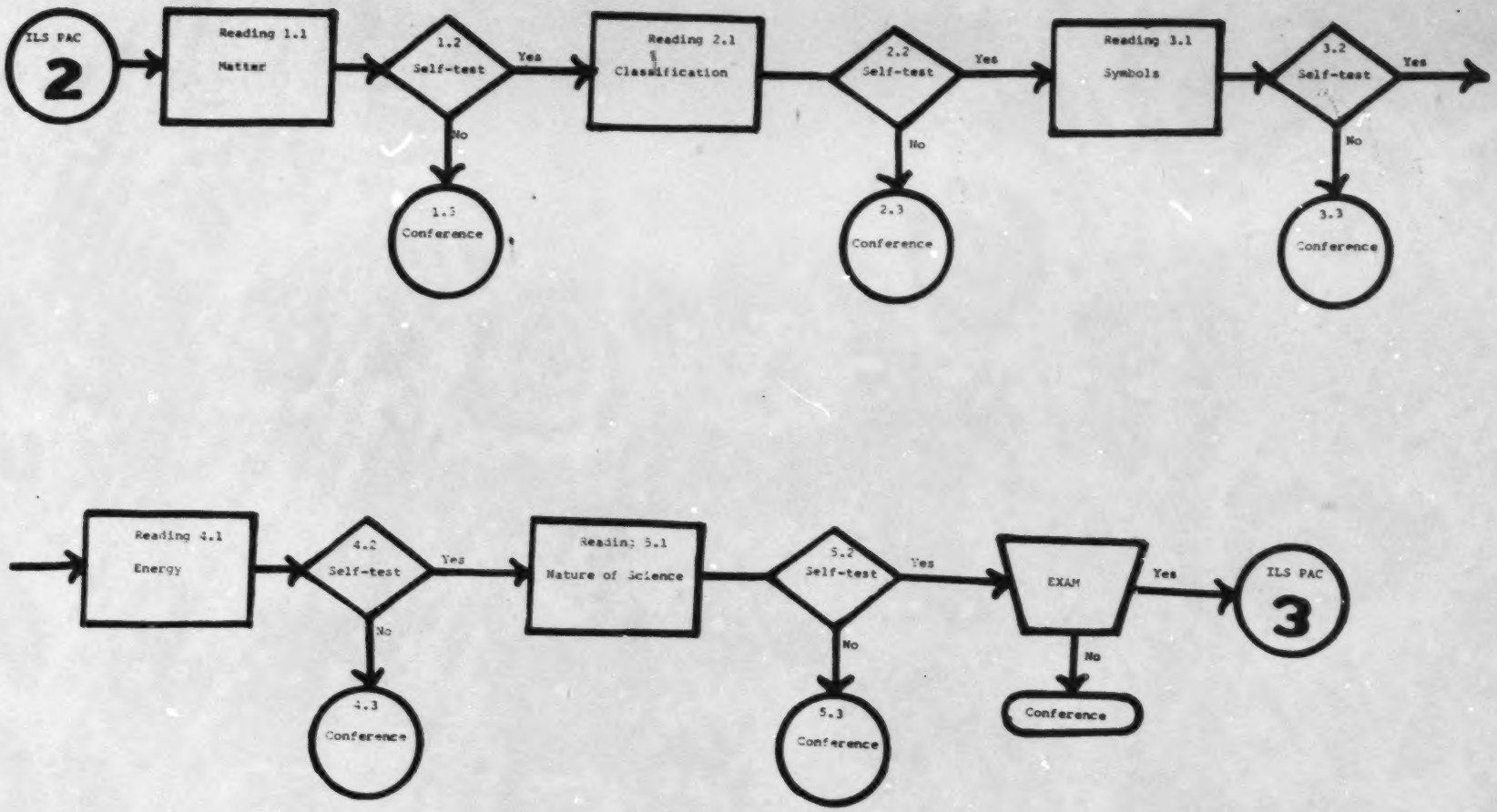
SE 021 423

Student No. & Name .....
Date Started .....
Date Completed .....

Atomic Weights of Elements (^{12}C = 12.0000 amu)

Element	Symbol	Atomic number	Atomic weight	Element	Symbol	Atomic number	Atomic weight
Actinium	Ac	89	(227)	*Mendelevium*	Md	101	(256)
Aluminum	Al	13	26.9815	*Mercury*	Hg	80	200.59
Americium	Am	95	(243)	*Molybdenum*	Mo	42	95.94
Antimony	Sb	51	121.75	*Neodymium*	Nd	60	144.24
Argon	Ar	18	39.948	*Neon*	Ne	10	20.179
Arsenic	As	33	74.9216	*Neptunium*	Np	93	237.0482
Astatine	At	85	(210)	*Nickel*	Ni	28	58.71
Barium	Ba	56	137.34	*Niobium*	Nb	41	92.9064
Berkelium	Bk	97	(249)	*Nitrogen*	N	7	14.0067
Beryllium	Be	4	9.01218	*Nobelium*	No	102	(254)
Bismuth	Bi	83	208.9806	*Osmium*	Os	76	190.2
Boron	B	5	10.81	*Oxygen*	O	8	15.9994
Bromine	Br	35	79.904	*Palladium*	Pd	46	106.4
Cadmium	Cd	48	112.40	*Phosphorus*	P	15	30.9738
Calcium	Ca	20	40.08	*Platinum*	Pt	78	195.09
Californium	Cf	98	(251)	*Plutonium*	Pu	94	(242)
Carbon	C	6	12.011	*Polonium*	Po	84	(210)
Cerium	Ce	58	140.12	*Potassium*	K	19	39.102
Cesium	Cs	55	132.9055	*Praseodymium*	Pr	59	140.9077
Chlorine	Cl	17	35.453	*Promethium*	Pm	61	(145)
Chromium	Cr	24	51.996	*Protactinium*	Pa	91	231.0359
Cobalt	Co	27	58.9332	*Radium*	Ra	88	226.0254
Copper	Cu	29	63.546	*Radon*	Rn	86	(222)
Curium	Cm	96	(247)	*Rhenium*	Re	75	186.2
Dysprosium	Dy	66	162.50	*Rhodium*	Rh	45	102.9055
Einsteinium	Es	99	(254)	*Rubidium*	Rb	37	85.4678
Erbium	Er	68	167.26	*Ruthenium*	Ru	44	101.07
Europium	Eu	63	151.96	*Samarium*	Sm	62	150.4
Fermium	Fm	100	(253)	*Scandium*	Sc	21	44.9559
Fluorine	F	9	18.9984	*Selenium*	Se	34	78.96
Francium	Fr	87	(223)	*Silicon*	Si	14	28.086
Gadolinium	Gd	64	157.25	*Silver*	Ag	47	107.868
Gallium	Ga	31	69.72	*Sodium*	Na	11	22.9898
Germanium	Ge	32	72.59	*Strontium*	Sr	38	87.62
Gold	Au	79	196.9665	*Sulfur*	S	16	32.06
Hafnium	Hf	72	178.49	*Tantalum*	Ta	73	180.9479
Hahnium	Ha	105	(260)	*Technetium*	Tc	43	98.9062
Helium	He	2	4.00260	*Tellurium*	Te	52	127.60
Holmium	Ho	67	164.9303	*Terbium*	Tb	65	158.9254
Hydrogen	H	1	1.0080	*Thallium*	Tl	81	204.37
Indium	In	49	114.82	*Thorium*	Th	90	232.0381
Iodine	I	53	126.9045	*Thulium*	Tm	69	168.9342
Iridium	Ir	77	192.22	*Tin*	Sn	50	118.69
Iron	Fe	26	55.847	*Titanium*	Ti	22	47.90
Krypton	Kr	36	83.80	*Tungsten*	W	74	183.85
Kurchatovium	Ku	104	(257)	*Uranium*	U	92	238.029
Lanthanium	La	57	138.9055	*Vanadium*	V	23	50.9414
Lawrencium	Lr	103	(257)	*Xenon*	Xe	54	131.30
Lead	Pb	82	207.2	*Ytterbium*	Yb	70	173.04
Lithium	Li	3	6.941	*Yttrium*	Y	39	88.9059
Lutetium	Lu	71	174.97	*Zinc*	Zn	30	65.37
Magnesium	Mg	12	24.305	*Zirconium*	Zr	40	91.22
Manganese	Mn	25	54.9380				

TERMINOLOGY



OBJECTIVES

Upon completion of the ILS Chem Pac on Chemical Terminology the student should be able to

1. Matter, Properties & Changes

Given a list of properties or changes, distinguish a physical property from a chemical property and a physical change from a chemical change--or vice versa--in 10 out of 11 such items listed.

2. Classification of Matter

Given the name or formula of a substance, identify the substance as an element, a compound, or a mixture--in 6 out of 7 such substances presented.

3. Symbols

With the aid of a Periodic Chart, given the name of an element, write the symbol--or given the symbol, name the element--in 13 out of 14 elements presented.

4. Energy

Calculate the amount of heat required, in calories, to change a given amount of water from one temperature to another for any given problem.

5. Nature of Science

Read a book--that is not a textbook but is similar to those mentioned in reading 5.1--about the nature of science or the work of research scientists and submit a written report of this reading.

ILS Chem Pac 2 - Chemical Terminology

[or "Learning A Foreign Language"]

Reading 1.1 - Read pages 12-13 in Medeiros, pages 11-13 in Sackheim & Schultz, and page 45 in Holum.
Notes:

The term matter can be defined as anything that has weight and occupies space, i.e., the entire physical world. Mass is the actual quantity of matter in any body and is constant. In contrast, the weight of a body varies with location because weight is defined as a force--the attractive force called gravitation which the earth exerts on a body.

Physically, matter can be classified as existing in the solid, liquid, or gaseous state. Matter can usually be changed from one state to another. When no new substance is produced this is called a physical change. The other type of change, a chemical change, is one in which new substances are produced that have entirely different properties from the original substance. These properties of matter are also classified into physical and chemical properties. Physical properties include melting point, boiling point, density, viscosity, surface tension, color and solubility in water. Chemical properties are sometimes indicated by the evolution of a gas, formation of a precipitate, a color change, or an energy change in the form of light or heat or both.

Self-test 1.2

Sackheim & Schultz: p. 22, #2 and #7.

Conference 1.3

If you are still having difficulty with distinguishing between physical and chemical properties and/or physical and chemical changes, please see your instructor.

Date:

Notes:

Reading 2.1 - Read pages 9 and 34-35 in Medeiros, pages 16-20 in Sackheim & Schultz, and pages 20 & 21 in Holum.
Notes:

Chemically, matter can be classified as either a substance or a mixture. Substances, in turn, can be either elements or compounds. Mixtures, in turn, can be either heterogeneous or homogeneous. A symbol, e.g. H, represents the concept of one atom of an element--the unit particle that takes part in a chemical change. A formula, e.g. H_2, is the smallest amount of a substance that represents its composition. When they exist as distinct particles, the term molecule is used. Otherwise, the term formula unit is appropriate for such substances as NaCl. The atomic weight of an atom is the relative mass of the atom compared to the mass of one carbon atom whose mass is exactly 12 atomic mass units. The gram atomic weight or gram-atom is the atomic weight expressed in grams and is the weight of 6×10^{23} atoms. The molecular or formula weight is the weight of a molecule or formula unit compared to the mass of one carbon twelve atom. The gram molecular weight or mole is the molecular weight expressed in grams and is the weight of 6×10^{23} molecules. The gram molecular volume is the volume occupied by one mole or gram molecular weight of any gas at standard temperature and pressure and has a value of 22.4 liters.

Self-test ◇ 2.2

Sackheim & Schultz: p. 22, #3.

Conference (2.3)

If you are still having difficulty with classifying matter and the terminology involved, please see your instructor.

Date:

Notes:

Reading 3.1 - Read page 8 in Medeiros, page 21 in Sackheim & Schultz, and page 26 in Holum.
Notes:

As noted in reading 2.1, each element can be represented by a symbol. The symbol B identifies the element boron. In this example the symbol is the first letter of the name of the element. However, this can not be used for every element. Therefore, some elements take the first two letters of the name for their symbol--for example, barium is Ba. Sometimes the symbol suggests a sound that is apparent in the name--for example, Zn for zinc. Still other symbols are based upon the Latin names of the elements. Na, the symbol for sodium, comes from the Latin word natrium.

Self-test ◇ 3.2

Sackheim & Schultz: p. 22, #9 and #10.

- OR -

GET-$ELMENT - This is a time limited CAI program in the public computer library for drill on the symbols for the elements.

Conference (3.3)

If you are still having difficulty with chemical symbols, please see your instructor.

Date:

Notes:

Reading 4.1 - Read pages 14-15 in Sackheim & Schultz, and pages 14 & 15 in Holum.
Notes:

A key word in defining chemistry is change. Changes involve energy. Energy is defined as the ability to do work. Energy is usually classified into two categories: kinetic energy associated with motion and potential energy which is stored energy. Heat is the most common form of energy. The unit of heat energy is the calorie which is defined as the amount of heat required to raise the temperature of one gram of water one degree Celsius.

Self-test ◇ 4.2

Sackheim & Schultz: p. 22, #6.

Conference (4.3)

If you are still having difficulty calculating amounts of heat energy in units of calories at this point, please see your instructor.

Reading 5.1 - Read pages 3-6 in Medeiros and pages 2-4 in Holum.

Notes:

Chemists, sometimes appear to converse in a language of their own. This activity will attempt to familiarize you with the language and concepts used to discuss chemistry. Many terms are difficult to define in only a few words--such as the term chemistry. Chemistry is such a wide ranging endeavor one could, not too facetiously, define chemistry as what chemists do. For discussion purposes, I will define chemistry as the science which deals with matter and the changes it undergoes. The key words of this definition are science, matter (Reading 1.1), and changes (Reading 4.1).

You have been provided with several books to help you understand the nature of science and its relationship to the world. Silica and Me is an illuminating view of one of the major fields of industrial chemistry--silica, the basic component of sand which covers over 60 percent of the earth's surface. This is not a textbook. It is a narrative that tells how Guy Alexander turned science into discoveries and discoveries into products--by hard work and now and then a lucky break. It is also an account of a scientist's transition from college professor at a large university to an industrial career of developing and refining silicon compounds.

Wednesday Night at the Lab: Antibiotics, Bioengineering, Contraceptives, Drugs and Ethics is a collection of lively and informative articles relating the work of research scientists to questions of social, political, and environmental impact. Many scientists describe their research in a broad range of topics--inherited disease, the role of herbicides in agriculture and defoliation, politics and birth control, chemotherapy and mental illness; among others--in language requiring only a high school background in chemistry.

Thomas Edison, Chemist is the story of an inventor, innovator, electrical and mechanical wizard - who was first and foremost a remarkably versatile chemist. He established the first industrial research laboratory in the United States. His work on a practical chemical composition for his phonograph records pioneered large scale fabrication of plastics. He was the first to prepare iron powder commercially by direct hydrogenation; the first to develop carbon fibers; the first to observe strong absorption of gases by platinum metal; the first to develop a commercial alkaline storage battery; etc. In this book the chemistry behind the problems Edison faced is explained and his methods and chemical know-how are illustrated by the ingenious ways he went about solving each difficulty. Thomas Edison -- the greatest American inventor -- was above all else a highly skilled applied chemist.

A brief (one page), typewritten report/reaction to one of these books will complete this activity.

Book report is due at time you complete next Pac.

Self-test

The written report and conference will be Self-test 5.2

Conference

Date:

Notes:

ILS Pac 2 Exam will consist of 10 questions.

Objective 1 - Matter - 2 questions

Objective 2 - Classification - 3 questions

Objective 3 - Symbols - 4 questions

Objective 4 - Energy - 1 question

Objective 5 - Nature of Science - book report and conference

See ILS Pac 0 (Student Directions) for Grading System Equivalents. Please remember that although the Exam is necessary for a grade it may not be sufficient. You may also be asked to have a final conference with your instructor.

CONFERENCE

Date:

Notes:

SUPPLEMENTARY MATERIAL

Objective 3 - Symbols

Element Card Game

Objective 4 - Energy

Audio-Tape A2: Energy Changes in Chemical Reactions

ANSWERS

Self-test 1.2

2. (a) physical
   (b) chemical
   (c) physical
   (d) physical
   (e) chemical

7. (a) physical
   (b) chemical
   (c) physical
   (d) chemical
   (e) physical
   (f) chemical

Self-test 2.2

3. (a) mixture
   (b) element
   (c) compound
   (d) mixture
   (e) element
   (f) compound
   (g) mixture

Self-test 3.2

9. (a) oxygen
   (b) nitrogen
   (c) iron
   (d) potassium
   (e) sodium
   (f) chlorine
   (g) hydrogen

10. (a) Mg
    (b) Ca
    (c) I
    (d) C
    (e) P
    (f) Zn
    (g) Cu

Self-test 4.2

6. 6,000 calories and 1.5 grams of protein

No. calories = No. grams of water x change in temperature in °C

COMPOUNDS
Formula (molecular) weight expressed in grams is the mass of a mole of molecules.
Examples:
44 g of carbon dioxide
18 g of water
95 g of calcium chloride
ELEMENTS
Atomic weight expressed in grams is the mas
of a mole of ator
Examples:
40 g of calcium
108 g of silver
207 g of lead
number of atoms in 12 g of carbon-12
MOLE
6.02 X 10^23 particles
GASES (Elements or Compounds):
22.4 liter volume at 0° C and 1 atm pressure is occupied by 1 mole of molecules of an "ideal" gas.
Facets of the mole: particle, elements, compounds, and gases.